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A critical framework for methodological research in architecture

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This paper reviews a cross-section of methodological studies undertaken in architecture since the Second World War. Despite a variety of orientations, technically, conceptually and philosophically, most studies reflect an understanding of people and objects as discrete entities interacting in a passive and unilateral manner. This dominant dualist understanding is concluded to be the essential cause of the 'implementation gap' between architectural research and practice. For the gap to close, the development and institution of a critical framework is needed which encourages researchers to acknowledge explicitly the ontological and epistemological issues associated with architectural practice, education and research. Underlying this recommendation is a dialectic appreciation of person-world interaction; one which accepts as a holistic theme for inquiry, the experiential and interpretative quality of human thinking, feeling and action.

Keywords: methodological research, critical framework, architecture, design

An overview of the workshop, 'Research in Design Thinking'[1], attributes the problem of knowledge transfer, from research to education and practice, to three main factors: firstly, the lack of a clear direction; secondly, the lack of a shared research methodology; and, thirdly the lack of a broad theoretical framework. In this paper, the onus for closing 'the implementation gap'[2] is placed on individual researchers working in a 'critical' mode in the context of architectural practice, education and research. Specifically, the paper calls for the development and institution of a framework which encourages researchers, heading in various directions and utilizing a range of methodologies, to acknowledge explicitly the values and assumptions implicit in human behaviour. To do this rigorously demands attention to epistemological issues involving knowledge, its nature and forms, how it is acquired and how it is communicated[3], and to ontological issues concerned with the relationship between people and the world.

To substantiate the argument for such an approach, I begin the paper with a critical review of methodological research undertaken in architecture since the Second World War. (It was at this time that researchers made a concerted effort to look away from architecture and its constituent elements and sought an external framework for their inquiry into the nature and development of design process and practice[4].) The review reveals that methodological research in architecture has operated, for the most part, with a dualist understanding of the world; an understanding which regards people and objects as discrete entities interacting in a passive and unilateral manner. Giving priority to an alternative dialectic view which asserts that 'people and their environment mutually include and define each other'[5], this paper, supported by research described in the review, suggests that it is the dominant dualist understanding with its associated conceptions of design, designing, education and research that prevents 'the implementation gap' from closing. For the gap to close, researchers must be prepared to accept, as a holistic theme for their inquiry, the experiential and interpretive quality of human thinking, feeling and action.

1 A review of methodological research in architecture

In reviewing methodological studies in architecture, three main orientations emerge which I refer to as 'technically orientated research', 'conceptually orientated research' and 'philosophically orientated research'.

1.1 Technically orientated research (with a systematic frame-of-reference)

Technically orientated research is distinguished from the other orientations by its emphasis on procedure as the chief determinant of effective design. There were several factors that contributed to its emergence in the 1950s. Of these the most pervasive was the dominance of consumerism and industrialized production[6]. In this context, design knowledge was regarded as instrumental in improving the efficiency and reliability of production, in adapting and developing production procedures to suit particular products, and in the conceptualization and execution of 'designs' aimed at accommodating and stimulating consumer demand.

By the 1950s, architecture and the other design disciplines at the forefront of industrialization, engineering and industrial design, were finding it increasingly difficult to respond effectively to demands for improved production. Consequently, with performance as a goal, researchers began to look for ways to make the design process more efficient and reliable. In this respect, they were influenced by various substantive and procedural 'advances' in technology and science, particularly in management science, communications science, computer science and behavioural psychology.

Focusing on psychology, for instance, Rowe[7] in his book, *Design Thinking,* identifies the doctrine of behaviourism as contributing to an understanding of design behaviour as a process that '…could be clearly and explicitly stated, relevant data gathered, parameters established, and the ideal artefact produced'. Contributing, in turn, to the behaviourist understanding of behaviour as environmentally determined was the scientistic demand for detached observation, quantification and replication. Fundamentally, it was the emphasis on a 'rational' approach to knowledge acquisition that prompted design researchers to conceive of efficiency and reliability in terms of the systematic application of technique; a move which helped to produce and continued to reinforce a mechanistic, deterministic conception of designing.

This understanding of designing as comprised of parts or stages bound by an identifiable and widely applicable 'law' is reflected in the various models and methods produced in the 1950s and 1960s. A decompositional method for establishing the requirements of a design situation was among those produced for architecture. The method proposed by Alexander[8] (a mathematician and architect) reflects the Cartesian process of breaking down a problem until the 'truth', or solution in this case, becomes self-evident. Specifically, for Alexander, this involved mathematically analysing and explicitly representing the problem in terms of a hierarchy of subsets of requirements. Identification of these subsets and their pattern of interaction provided the logic for the recombination of the subsets in physical form. The basis of this approach is the belief that design is concerned with the 'invention of physical tings', and that designing begins with an effort to achieve fitness between two entities: the form in question; and, the problem situation.

1.2 Technically orientated research (with a computational frame-of-reference)

In the 1970s, the systematic frame-of-reference which had informed research such as Alexander's developed more conclusively into a computational frame-of-reference. Researchers working from this platform regarding designing as a process amendable to symbolical (numerical) representation, interpretation and management by a computer. The emergence of this view can be attributed to early research involving information processing

and cognition[9,10], and to more recent research in cognitive science and artificial intelligence[11,12].

In architecture, as in other design disciplines such as engineering and industrial design, research with a computational frame-of-reference has moved in two main directions: computer-aided design (CAD); and, knowledge-based design. As studies have shown[13-15], by the 1980s CAD had proved to be beneficial in many areas of design process and practice including information storing, retrieving, processing and printing.

The book, *Computer-Aided Architectural Design*, by Mitchell[15] is identified by Gero[16] as significant in encapsulating the developments in computer-aided design up to the beginning of the 1980s. In addition to this, it also supports a computational model for understanding and improving the architectural design process. According to Mitchell

> Each project can be viewed as proceeding by the performance of various functions, each making the achievement of some identifiable goal. Performance of each function requires the execution of some design procedure, which requires certain data as input, produces certain data as output, and consumes certain resources. As a design project progresses, the output from procedures accumulate, and an extensive, complex, project data base is built up. The project is complete when this data base contains a sufficiently complete, consistent, and detailed description of the proposed building to form a basis for a contract and for actual construction work.[17]

With this conception of designing, Mitchell saw the computer as having considerable potential for architectural designing. Indeed, in later work[18], he draws extensively upon advances in artificial intelligence, cognitive science and the theory of computation in an attempt to demonstrate that the structure of architectural design reasoning can be understood by analysing logically (through the notation of first-order predicate calculus) how architects conceptualize form and function. Here the distinguishing feature of Mitchell's thesis is the belief that the construction world, and subsequently, the design process, are for the most part, controlled by a formal language. Specifically, this language comprises of vocabulary and rules of usage (a typology) which have evolved over time for various parts of a building and, in some cases, for the building as a whole. He further proposes that this understanding of the design process makes it appropriate for computer management eventually leading to improved efficiency and effectiveness.

While CAD proved to be effective in handing well-defined problems, in managing ill-defined problems it was severely limited. In general, ill-defined or ill-structured problems[19] do not possess any definite criterion for testing a proposed solution nor a mechanical process for applying the criterion. As a result, the designer is forced into an iterative mode of proposing tentative solutions which are then tested by stimulating the situation through drawings and models. Responding to this conception of designing as heuristic search involving closure of a goal state[20], a new field, which is described generally as knowledge engineering, was established. Concerned with improving designers' knowledge of the relationship between potential solutions and desired performance characteristics, knowledge research has concentrated on producing systems that contain the problem solving 'facts' and rules associated with specific types of design problems; rules involving simulation, generation and optimization. McDermott[21], Radford and Gero[22], Coyne *et al.*[23] and Balachandran[24] have provided a detailed account of the development of knowledge-based design systems in the 1980s.

Predictions for future research operating within this rationalist paradigm include the improvement of networking capabilities, the development of automated criticism systems that behave increasingly like human critics drawing on different knowledge bases, and the development of 'professional' memories containing collections of shape rules for access by designers[12]. Whether this is an appropriate direction to take has been questioned by various researchers including Coyne and Snodgrass[25] and Dreyfus[26]. Earlier criticisms of computational research by Winograd and Flores[27] have been influential.

Working form the premise that technological development takes place within a context and that this technology subsequently leads to fundamental changes in society's way of thinking and doing, Winograd and Flores[28] urge researchers to make '…explicit the implicit understanding of design that guides technological development…'. According to them, it is the reconsideration of the hermeneutic idea of interpretation and meaning that should provide the basis for new possibilities in computer technology.

1.3 Technically orientated research (with a management frame-of-reference)

Research in CAD and knowledge engineering has focused on specific design problems involving building form and its realization. Attempts, however, to address the complex array of professional practice issues have been insignificant by comparison. Reviewing the state-of-the-art in architectural management research, Akin[29] identifies only a limited number of studies undertaken in architectural management in the last few decades. Among those identified are socio-historical accounts of office practice by Gutman[30] and Cuff[31], research by Mackinder and Marvin[32] concerned with design information and its management, and studies by Haviland[33] which found attempts by practitioners to formalize management restricted almost entirely to organizational structure and its generalist, studio, departmental or matrix model.

In response to the demand for more extensive architectural management research, studies aimed at confronting the newly emerging forces of architectural practice are currently under way. While some of this research attempts to acknowledge contextual factors, the recommendations by Winograd and Flores[27] to consider the historical context of those involved in designing, especially their tacit understandings of design and designing, remain largely unheeded.

In summary, design researchers who are 'technically orientated' define their role with respect to the efficient and effective production of objects. As previously noted, the tendency to understand efficiency and effectiveness as the systematic, mechanical matching of form with requirement dominated methodological research in the 1950s and 1960s leading to the development of various 'rigid state models'[4] including the decompositional method by Alexander[8]. It was not long before the inadequacies of these methods in coping will the ill-definition and uncertainty of design practice, became apparent, motivating researchers "…to look behind the methods at the conceptual processes which were generating them'[34].

1.4 Conceptually orientated research (a psychological frame-of-reference)

There are two dominant frames-of-reference associated with conceptually orientated research; a psychological frame-of-reference, and a person-environment frame-of-reference. Researchers adopting a psychological frame-of-reference tend to see designing as one or a combination of the following: a 'rational' process involving information processing; a constructive process in which designers actively draw on knowledge from past experience, particularly past design experience; a creative process utilizing an intuitive form of reasoning.

Each of these conceptions in turn reflects a specific view about knowledge and subject-world interaction. For example, researchers who understand designing as information processing regard knowledge in terms of two basic types of information: substantive information, or 'facts' about the real (objective) world; and, procedural information which indicates how to arrive at a factual understanding of objective reality. For them, research is driven by the goal of matching knowledge with problem.

In architecture, research concerned with the nature of design problems[35], problem definition and solution generation[20,36], and design knkowledge[36-38] reflects attempts by researchers to

apply the theory of problem solving developed by Newell and Simon[39] to designing. The descriptive model by Akin[40] illustrates the result of such an attempt.

Describing the design process, Akin refers to it as a problem solving process comprising three major activities: problem representation; problem transformation utilizing a particular body of knowledge; and, searching which involves the designer in matching resources with the task at hand. Integral to theses activities are three types of knowledge: representational knowledge, transformation knowledge and procedural knowledge. For managing the information there is a design information processing systems (DIPS) similar to that proposed by Newell and Simon[10]. While the system has performed well in computer simulation tests, its use in a range of individually and socially constructed situations has yet to be demonstrated.

This model and others, including Mitchell's[18], while psychologically framed, are ultimately technically orientated. Underlying and guiding their mechanistic approach to research and their 'technical fix' attitude to practice is an atomistic, deterministic appreciation of the world; a world where the relationship between people and objects is perceived as static and discrete.

It is interesting to note that while this dualist notion is fundamental, there is also an acceptance of the role played by knowledge. Cognitive scientists and schema theorists involved in knowledge engineering are expanding their focus from knowledge *per se* to knowledge as constructed from and through experience; that is, to aspects of a designer's historical context. In doing this, there is a recognition, even if only implicit, of the interpretive quality of interaction and of knowledge acquisition as active rather than passive.

Contributing to this change of emphasis in computational research is an emerging homogeneous view of creativity and thinking. This view which is reflected in research by Sternberg[41], Mumford and Gustafson[42] and Heath[43] attributes the ability to respond in a 'novel' way to both the individual's capacity and willingness to generate and act on new ideas or understandings and the responsiveness of the environment to these demands. Despite a growing recognition of this view, the traditional understanding of creativity as an intuitive form of thinking separate to thinking labelled as 'rational' persists.

1.5 Conceptually orientated research (a person-environment frame-of-reference)

While some researchers have bee concerned with the cognitive factors associated with behaviour, other researchers have been working from a person-environment frame-of-reference, focusing, for the most part, on the social and cultural factors involved in individual and group behaviour. In the 1970s, this research, together with an increasing awareness of social and environmental issues, influenced architecture and design in a number of ways. In response to the newly emerging awareness of 'social' reality and growth of community-orientated programmes, for instance, design researchers turned their attention to the collective rather than individual consciousness, to shared meaning rather than idiosyncratic meaning, to collaborative designing rather than autocratic designing.

In line with the conception of designing as collaborative, research focused on the development of methods and models that could support client/user participation in the design process. Wisner *et al*.[44] provides a detailed overview of participatory and action research since its emergence in the 1960s, identifying among others the simulation games of Sanoff[45] and the environmental models of Lawrence[46]. In general, the models developed reflect various dimensions of the conception of collaboration in designing. One typical dimension is the understanding of collaboration as a method to arrive at an intersubjective understanding of the design situation. What is generally emphasized in these cases is communally shared information about requirements. Underlying this approach is a belief that reality for an individual is socially constructed and that individual behaviour is determined chiefly by social and cultural norms.

Researchers believed that attention to these 'facts' would produce more meaningful environments. They also believed that involving users in the designing process would reduce the risk of rejection of the building or object. Despite research based on these beliefs, practicing designers have preferred to take a less collaborative approach, justifying it with respect to the large numbers of people involved or restrictive budgets and time frames. Whilst these may have constituted legitimate factors in some situations, the general lack of application is more likely due to designers being unprepared ideologically for a new way of thinking about design and designing. This and the influential nature of the practice setting have been almost ignored by researchers.

In 'recent' studies of design practice Blau[47], Gutman[30] and Cuff[31] highlighted problems caused by a discord between professional ideology and practice which has its own values, language, power structure and practices. According to Cuff's ethnographic study, these aspects of practice culture are reflected in the practitioners' theories-in-action. In many cases these theories are contradictory to the theory of practice espoused by the profession and the various schools of architecture. From this understanding of architecture as a socially constrained process, Cuff called on educational institutions and professional bodies to encourage architects to 'reconstruct their vision of their task'[48].

The research just described deals directly with the social quality of designing. In addition to this is other person-environment research which, while not contributing directly to procedural theory in architectural design, does so indirectly through its emphasis on the meaning of place and the nature of the user in relation to physical, social and cultural environments. Of fundamental significance is its acknowledgement of alternative world views and of the need for a holistic, interdisciplinary and broad-based approach to inquiry[49].

Frustrated with the static model of human behaviour, a number of social psychologists in the 1960s and 1970s sought an alternative model for understanding complex human behaviour and experience. Proshansky for example, preferred to describe the person as a dynamic organism whose behaviour is determined by psychological processes; processes which, in turn, are affected by biological, social and situational factors[50]. Current research by Proshansky concerns place identity and how it is influenced by such things as feelings and conceptions about behaviour relevant to particular physical settings, by other people and their attitudes, and by the social meanings associated with selected environments[51].

Research by Cooper Marcus has also focused on the meaning of place; in particular how people feel emotionally and spiritually about specific designed settings. While the outcome of her studies of public housing such as Easter Hill Village[52] have provided useful substantive information for designers, they also have contributed in a normative sense by highlighting the need for postoccupancy evaluation, and in a procedural sense through the development of various techniques including participant and nonparticipant observation, focused and nonfocused interviewing and archival searching.

Research by Rapoport, on the other hand, focuses on culture and its influence on built form. From studies of vernacular architecture Rapoport[53] has concluded that 'place' has more to do with social, cultural and psychological factors than it has with the built environment. At the basis of his research is an explicit desire to make architecture 'more scientific' by replacing it with a research emphasis. Rather than making research applicable for designers, '…it was designers that needed changing, to see research as essential'[54]. In effect then, design would become applied environment-behaviour research but with one major qualification; it must remain 'rational'. Consciousness raising, existentialism, phenomenology, holism and hermeneutics are not considered by Rapoport to be 'rational'[55] and, consequently for him, do not constitute valid or valued research.

Despite a tendency for research such as that by Proshansky and Cooper Marcus to be deterministic through its attempt to identify patterns of behaviour and to attribute cultural or social causes to these patterns, it is more aligned with a dialectic appreciation of person-environment interaction than the dualist conceptualization of Rapoport. Phenomenology is a

methodology which has attempted to remain true to the view of human 'being' as dialectic. As opposed to seeing designing as a social or cultural process, phenomenological researchers in architecture understand it as a influence of this methodology in architecture and architectural research is described in the following section dealing with philosophically orientated research.

1.6 Philosophically orientated research (an epistemological frame-of-reference)

Influenced by modern science's rejection of metaphysics, philosophical inquiry has been largely epistemological in nature, that is, it has dealt with the basis of knowledge, its nature and forms, how it can be acquired and how it is communicated[3]. For the most part, these aspects of inquiry have been addressed exclusively by the method of inquiry. 'It was especially the idea of method, or of securing the path of knowledge in accord with the guiding ideal of certainty, that brought a unified meaning of knowing and knowledge to the fore'[56].

From 1950s, the appropriateness of 'the scientific method' came under attack by an increasing number of researchers. The logical criticisms of Popper[57], the sociological concerns of Kuhn[58] and the pragmatic objections of Feyerabend[59] were of significance for designer researchers. Endorsing Feyerabend, Abel[60] argues against an explicitly laid down method of inquiry, preferring to adopt the extreme position that there should be as many approaches to design research as there are researchers. His argument rests on the belief that research is about self-enlightenment and self-fulfilment. In this sense, individual approaches to inquiry are seen to be more appropriate than those promoted by the research community; a view influenced by the earlier discussion by Kuhn[58] of sociological barriers to methodological change.

Contributing to the understanding that designing involves conjecture and analysis rather than analysis, synthesis and evaluation was researched by Popper[61]. Counter to the traditional inductivist or deductivist views, Popper believed that scientific investigation proceeds by conjecture then refutation. While Popper concerned himself with the refutation aspect of research, design researchers[37,62,63] emphasized the conjecture element of designing. For them methodological research should concentrate on providing designers with knowledge on how human beings respond to objects, particularly designed objects. More cautious are the recommendations by Foque[64] that designers make a concerned effort to be aware of the operational limits of theoretically produced information including design methods.

1.7 Philosophically orientated research (an ontological frame-of-reference)

Underlying all research, including that of an epistemological nature, are assumptions regarding the relationship between human beings and the world. Despite extensive acknowledgment of these ontological concerns in sociology and psychology, there has been very little explicit response by the design disciplines such as architecture. Of the studies relevant to architecture, most have tended to borrow from research that is either rationalist oriented or empiricist oriented. Very few studies reflect holistic view characteristics of existentialist phenomenology and hermeneutics. Among the exceptions are studies by Coyne and Snodgrass, Schön, Dilnot and Norberg-Schulz.

Influenced by Gadamer and Heidegger's hermeneutic phenomenological philosophy and Dewy's pragmatism, Coyne and Snodgrass[25] criticize the dual knowledge thesis traditionally attributed to design thinking. For them, the thinking associated with designing involves negotiation between what is expected and what is presented in the situation. In other words, Coyne and Snodgrass see designing as an experiential and interpretive process. A similar understanding of designing and professional practice in general, was conveyed in earlier studies by Schön[65] who called on research to support designers in their reflective conversation with the materials of the situation. According to Schön, designers should be encouraged to analyse critically the tacit and explicit understandings of those involved in designing as well as the organizational structure in which design and designing are embedded.

Emphasizing the existentialist influence of design in human experience is research by Dilnott[66] who questions the nature of design-society relationships. For Dilnot, all too often this relationship is used with reference to the demand and outcome aspect of designing rather than in relation to how it 'orders the world' through its involvement with technological, economic and humanistic concerns.

Also of significance to architecture and a phenomenological understanding of design and designing is research to do with dwelling carried out in geography[67] and philosophy[68]. Underlying these studies is research by the philosopher Heidegger. For Heidegger[69], dwelling is a way of existing, or 'being-in-the-world'; a 'being' which originates in a person's everyday active involvement with the world. Subsequently, to understand the nature of this existence demands attention to the action and the context in which the action is grounded. An area of study which focuses on understanding in this way is hermeneutics.

Despite the apparent relevance of hermeneutics and phenomenology, very few studies have been undertaken in architecture. Of the studies undertaken, those by Norberg-Schulz are the most extensive. According to Norberg-Schulz, 'man dwells when he can orientate himself within and identify himself with an environment, or, in short, when he experiences the environment as meaningful'[70]. Rather than basing the design of a building upon general types of principles, Norberg-Schulz advocates that architecture should aim to concretize economic, social, political and cultural intentions in a way which captures the 'genius loci' or 'sense of place' of an environment[71].

This decision by Norberg-Schulz to reduce dwelling to concepts of identification and orientation has been criticized by Buechi. For Buechi[72], Norberg-Schulz's work is phenomenologically unresolved, reflecting a structualist semiotic approach rather than a hermeneutic phenomenological approach. Discussing hermeneutic phenomenology, Buechi sees its role in addressing problems which are the result of a technological interpretation of what it means to be. In general, he calls on designers and researchers to raise the level of their awareness by exploring the potential of phenomenological thought for building[73]. His PhD dissertation titled, 'Interpreting buildings as interpretations: towards a hermeneutics of building', is an example of one such attempt.

1.8 Review summary

As the review shows, methodological research in architecture has occupied, for the most part, a 'technological fix' role in society. An investigation of the context of methodological research reveals several factors contributing to the consolidation of this situation. These include: consumerism and its emphasis on production efficiency and effectiveness; technical, social and environmental problems caused, in many cases, by industrialization itself; and, scientific and technological development with its underlying atomistic and deterministic consciousness. Influenced by these factors, researchers have been preoccupied with developing methods that could improve the efficiency and reliability of the design and production process. As I have noted, this is evident to a large extent in technically oriented research where researchers have adopted a systematic-, computational-, or management-frame-of-reference.

Despite the deficiencies of these methods and a transition to conceptually orientated inquiry with its associated psychological and person-environment frames-of-reference, researchers have persisted in adopting a mechanistic, deterministic approach. This has occurred even though a considerable amount of environment-behaviour research has sought to move away from a dualist understanding of person-world interaction towards a more dialectic understanding. Of these studies, however, very few focus directly on the interconnectedness between people and the range of aspects constituting an environment. Ultimately, most researchers regard environmental factors such as culture as the primary origin or cause of behaviour and its concrete manifestations.

In this paper, this is attributed to four dominant conceptions which have been instrumental, generally, in isolating philosophical inquiry and limiting it, in architecture, to a meagre collection of epistemological and ontological studies. These include the conception of the world as atomistic; the conception of research as primarily prescriptive and interventionist; the conception of designing as rationalistic; and, the conception of design, or, more specifically architecture, in purely physical and/or formal terms. Despite their various foci, these conceptions give priority to the object, reinforcing in the process, a subject/object duality. As outlined in the following section, this dualist understanding has implications for future studies concerned with architecture and its practice.

2 Implications for future research

If dualist oriented conceptions continue to dominate inquiry, researchers and designers will carry on addressing problems largely form a domain specific viewpoint, that is, they will tend to attribute problems in practice to a lack of knowledge about how to best match form with specific functional and aesthetic requirements. While this knowledge is effective in well-defined situations, it is inadequate in situations where certain underlying elements such as values are brought to the fore; situations generally described as complex or novel. It is also inappropriate when the decisions made have fear-reaching implications for individuals and society as a whole. Despite these deficiencies, however, substantive and procedural theory will continue to be produced independently of each other and of practice; the world and objects will still be conceived of as discrete entities; and designers will go on experiencing conflict between formal knowledge and knowledge as interpreted from and through experience.

For this situation to change, researchers must be prepared to question underlying assumptions and values. They must be open to the possibility that the established way of viewing and exploring the world is, in many ways, ontologically and epistemologically inappropriate. Supporting this understanding is a body of research which suggests that problems such as knowledge transfer from research to education and practice are related to a narrow and restrictive appreciation of the interpretive and context dependant nature of human experience and behaviour. As revealed in the review, methodological research in architecture has given this understanding only spasmodic and highly selective attention. For these reasons, I call on researchers to consider a critical framework for their inquiry. In this context, a critical framework is one which encourages researchers to: firstly, question the basis upon which they frame and conduct their research; secondly, explore and consider alternative perspectives on the issues related to their field; thirdly, develop a wider appreciation of research in areas additional to their own; and finally, support designers and educators in the context of their practice.

2.1 A critical framework for methodological research in architecture

Adopting a critical framework for research will necessitate certain fundamental changes. Ontologically, it will demand a change from a dualist understanding of people and the world to one that is dialectically oriented. Epistemologically, it will require that explicit attention be given to the interpretive and context-bound nature of knowledge. Such changes will have various implications for how design, designing, learning to design and research are conceptualized.

Alternative to an understanding of design in purely physical and formal terms will be the understanding of it in qualitative terms. While the role of design can be described with respect to its technical involvement in meeting basic functional and commodity demands, it can also be viewed as something which, via the medium of form and its quality, is an integral part of experience and, as such, is instrumental in how people relate to the world. From this viewpoint, it is the role of the designer to inquire into the nature of this relationship.

'…To characterise how something is apprehended, thought about, or perceived is by definition a qualitative question'[74]. In this qualitative context, designing is critically reflective rather than systematically mechanical. In this qualitative context, initial consideration is given to experience as the source and mediator of knowledge rather than to the world as it is physically removed from its context of meaning. In this qualitative context, learning does not happen passively through the transmission of knowledge from expert to novice but as a reflective dialogue with the materials of the situation[65]. Experientially, the materials of the situation include the factors that influence how those involved in learning, '…conceptualise, perceive and understand various aspects of, and various phenomena in, the world around them'[75]. Fundamentally then, teaching designing, like designing, requires insight into how understandings of particular phenomena are constructed. Not only is this seen to be instrumental in the development of technical knowledge and skills but when approached explicitly and contextually, it also equips students with new ways of seeing things; ways which help them, personally and professionally, to make sense of a changing and uncertain world.

In view of these alternative conceptions of design, designing and learning to design, research will be required to shift its initial emphasis from prescriptions to description. As well as changing the focus of inquiry, researchers must also be prepared to adopt a second-order perspective. They must be willing to accept, as a worthwhile starting point, the designers' and students' experiences rather than attempting to describe designing and learning as concepts independent of their context (a first-order perspective).

On the whole, for research to be more relevant to educators and practitioners, it must operate within a framework where there is a commitment by researchers to explore critically, rigorously and ethically the ontological and epistemological issues associated with architectural practice, education and research. Fundamentally, researchers must be prepared to accept, as a holistic theme for their inquiry, the experiential and interpretive quality of human thinking, feeling and action.

[1] **Cross, N, Dorst, K and Roozenburg, N** (Eds) *Research in Design Thinking* Delft University, The Netherlands (1992)
[2] **Sommer, R** 'A fish who studies water' in *Environment and Behaviour Studies* **I Altmand and K Christensen** (Eds) Plenum Press, New York (1990)
[3] **Cohen, L and Manion, C** *Research Methods in Education* (3rd edn) Routledge, London (1989)
[4] **Rowe, P** *Design Thinking* MIT Press, Cambridge, MA (1987)
[5] **Bognar, B** 'A phenomenological approach to architecture and its teaching in the design studio' in *Dwelling, Place and Environment* **D Seamon and R Mugerauer** (Eds) Martinus Nijhoff, Dordrecht (1985)
[6] **Easlea, B** *Liberation and the Aims of Science* Chatto and Windus, London (1973)
[7] **Rowe, P** *ibid* p 49
[8] **Alexander, C** *Notes on the Synthesis of Form* Harvard University Press, Cambridge, MA (1964)
[9] **Eastman, C** 'Cognitive processes and ill-defined problems: a case study from design' in *Proceedings of the International Joint Conference on Artificial intelligence* **D Walker and L Norton** (Eds) The Mitre Corporation, Bedford (1969)
[10] **Newell, A and Simon, H** *Human Problem Solving* Prentice Hall, Englewood Cliffs, NJ (1972)
[11] **Charniak, E and McDermott, D** *Introduction to Artificial Intelligence* Addison Wesley, Reading, MA (1985)
[12] **Mitchell, W** 'Computer aided architectural design: eight predictions for the year 2000' in *The Technology of Design* ANZAScA Conference Proceedings **G Woodbury** (Ed) University of Adelaide, Adelaide (1991)
[13] **Murthy, H and Coyne, R** 'Computer use in architecture schools and practices' in *The Technology of Design* ANZAZcA Conference Proceedings **G Woodbury** (Ed) University of Adelaide, Adelaide (1991)
[14] **Radford, A and Woodbury, R** 'Preliminary notes on computational design and the remaking of architectural education' in *The Technology of Design* ANZAZcA Conference Proceedings **G Woodbury** (Ed) University of Adelaide, Adelaide (1991)
[15] **Mitchell, W** *Computer-Aided Architectural Design* Van Nostrand Reinhold, New York (1977)

[16] **Gero, J S** 'Computer-aided architectural design – past, present and future' *Arch. Sci. Rev.* Vol 1 (1983) 2–5
[17] **Mitchell, W** *ibid* p 66
[18] **Mitchell, W** *The Logic of Architecture* MIT Press, Cambridge, MA (1990)
[19] **Simon, H** 'Structure of ill-structured problems' *Artificial Intelligence* Vol 4 (1973) 181–201
[20] **Wade, J** *Architecture, Problems and Purposes: Architectural Design as a Basic Problem Solving-Process* John Wiley, New York (1977)
[21] **McDermott, J** 'Domain knowledge and the design process' *Design Studies* Vol 3 No 1 (1982) 31–36
[22] **Radford, A and Gero, J S** *Design by Optimization in Architecture, Building and Construction* Van Nostrand Reinhold, New York (1988)
[23] **Coyne, R, Rozenman, M, Radford, A, Blachandran, M and Gero, J S** *Knowledge-Based Design System* Addison-Wesley, Reading, MA, (1990)
[24] **Balachandran, M** *Knowledge-Based Optimum Design* CMP, Southampton, UK (1990)
[25] **Coyne, R and Snodgrass, A** 'Is designing mysterious? Challenging the dual knowledge thesis' *Design Studies* Vol 12 No 3 (1991) 124–131
[26] **Dreyfus, H** *What Computers Still Can't Do* MIT Press, Cambridge, MA (1993)
[27] **Winograd, T and Flores, F** *Understanding Computers and Cognition, A New Foundation for Design* Ablex, Norwood, NJ (1987)
[28] **Winograd, T and F** *ibid* p 5
[29] **Akin, O** 'Project management and architectural service' NSF Sponsored Research Project Working Paper No 1 Department of Architecture, Carnegie Mellon University, Pittsburg, PA (1990)
[30] **Gutman, R** *Architectural Practice, A Critical View* Princeton Architectural Press, New York (1988)
[31] **Cuff, D** *Architecture: The Story of Practice* MIT Press, Cambridge, MA (1991)
[32] **Mackinder, M and Marvin, H** 'Design decision making in architectural practice' Research Paper 19 Institute of Advanced Architectural Studies, University of York, York, UK (1982)
[33] **Haviland, D** *Managing Architectural Projects: The Process* Institute of Architects, Washington, DC (1981)
[34] **Evans, B, Powell, J and Talbot, R** (Eds) *Changing Design* John Wiley, Chichester, UK (1982) p 10
[35] **Rittel, H and Webber, M** 'Dilemmas in a general theory of planning' *Policy Sci.* Vol 4 (1973) 155–169
[36] **Thomas, J and Carroll, J** 'The psychological study of design' in *Developments in Design Methodology* **N Cross** (Ed) John Wiley, Chichester, UK (1984)
[37] **Darke, J** 'The primary generator and the design process' in *Developments in Design Methodology* **N Cross** (Ed) John Wiley, Chichester, UK (1984)
[38] **Eckersley, M** 'The form of design processes: a protocol analysis study' *Design Studies,* Vol 9 No 2 (1988) 86–89
[39] **Newell, A and Simon, H** *Human Problem Solving* Prentice Hall, Englewood Cliffs, NJ (1972)
[40] **Akin, O** *Psychology of Architectural Design* Pion Ltd, London (1986)
[41] **Sternberg, R** (Ed) *The Nature of Creativity* Cambridge University Press, Cambridge (1988)
[42] **Mumford, M and Gustafson, S** 'Creativity syndrome: integration, application and innovation' *Psychol. Bull.* Vol 103 No 1 (1988) pp 27–43
[43] **Heath, T** 'Social aspects of creativity' in *Modelling Creativity and Knowledge-Based Creative Design* **J Gero and M Maher** (Eds) Lawernce Erlbaum, Hillsdale, NJ (1993)
[44] **Wisner, B, Stea, D and Kruks, S** 'Participatory and action research methods' in *Advances in Environment, Behaviour and Design* **E Zube and G Moore** (Eds) Plenum Press, New York (1991)
[45] **Sanoff, H** (Ed) *Designing with Community Participation* Dowden, Hutchison & Ross, Stroudsberg (1978)
[46] **Lawrence, R** 'Designer's dilemma: participatory design methds' in *Knowledge for Design* Proceedings of the Thirteenth International Conference of the Environmental Design Research Association **P Bart, A Chen and G Francescato** (Eds) EDRA Inc. (1982)
[47] **Blau, J** *Architects and Firms, A Sociological Perspective on Architectural Practice* MIT Press, Cambridge, MA (1984)
[48] **Cuff, D** *ibid* p 250
[49] **Altman, I and Christensen, K** (Eds) *Environment and Behaviour Studies, Emergence of Intellectual Traditions* Plenum Press, New York (1990) p 2
[50] **Proshansky, H** 'The pursuit of understanding' in *Environment and Behaviour Studies* **I Altman and K Christensen** (Eds) Plenum Press, New York (1990) p 12
[51] **Proshansky, H** *ibid* pp 26–29
[52] **Cooper Marcus, C C** *Easter Hill Village: Some Social Implications of Design* Free Press, New York (1975)
[53] **Rapoport, A** 'Science and the failure of architecture' in *Environment and Behaviour Studies* **I Altman and K Christensen** (Eds) Plenum Press, New York (1990) p 92
[54] **Rapoport, A** *ibid* p 99

[55] **Rapoport, A** *ibid* p 106
[56] **Gadamer, H** *Reason in the Age of Science* MIT Press, Cambridge, MA (1986) p 156
[57] **Popper, K** *Logic of Scientific Discovery* Hutchinson, London (1959)
[58] **Kuhn, T** *The Structure of Scientific Revolutions* University of Chicago Press, Chicago (1962)
[59] **Feyerabend, P** *Against Method* New Left Books, London (1975)
[60] **Abel, C** 'The case for anarchy in design research' in *Changing Design* **B Evans, J Powell and R Talbot** (Eds) John Wiley, Chichester, UK (1982)
[61] **Popper, K** *Conjectures and Refutations* Routledge & Kegan Paul, London (1963)
[62] **Daley, J** 'Design creativity and the understanding of objects' in *Developments in Design Methodology* **N Cross** (Ed) John Wiley, Chichester, UK (1984)
[63] **Hiller, B, Musgrove, J and Sullivan, P** 'Knowledge and Design' in *Developments in Design Methodology* **N Cross** (Ed) John Wiley, Chichester, UK (1984)
[64] **Foqué, R** 'Beyond design methods – arguments for practical design theory' in *Changing Design* **B Evans, J Powell and R Talbot** (Eds) John Wiley, Chichester, UK (1982)
[65] **Schön, D** *The Reflective Practitioner* Basic Books Inc., New York (1983)
[66] **Dilnot, C** 'Design as a socially significant activity: an introduction' *Design Studies* Vol 3 No 3 (1982) 139–146
[67] **Relph, E** 'Geographical experiences and being-in-the-world: The phenomenological origins of geography' in *Dwelling, Place and Environment* **D Seamon and R Mugerauer** (Eds) Martinus Nijhoff, Doredrecht, The Netherlands (1985)
[68] **Mugerauer, R** 'Language and the emergence of the environment' in *Dwelling, Place and Environment* **D Seamon and R Mugerauer** (Eds) Martinus Nijhoff, Doredrecht, The Netherlands (1985)
[69] **Heidegger, M** *Being and Time* translated by J Macquarrie and R Edward, Harper & Row, New York (1962)
[70] **Norberg-Schulz, C** *Genius Loci: Towards a Phenomenology of Architecture* Rizzoli International, New York (1980) p 5
[71] **Norberg-Schulz, C** *ibid* p 5
[72] **Buechi, G** 'Interpreting buildings as interpretations: Towards a hermeneutics of building' Doctor of Philosophy Dissertation, University of California, Berkley (1991)
[73] **Buechi, G** *ibid* p 3
[74] **Marton, F** 'Phenomenography: exploring different conceptions of reality' in *Qualitative Approaches to Evaluation in Education* **D Fetterman** (Ed) Praeger, New York (1998) p 181
[75] **Marton, F** *ibid* pp 178–179